

## C.2 Images solution

### C.2.1 In-lab section

1. White is represented as [1.0, 1.0, 1.0] and black as [0.0, 0.0, 0.0].
2. The following script does the job:

```
>> k = 0:199;
>> x = (sin(k*2*pi/200 + pi/2) +1)';
>> b = 128 * repmat(x, 1, 200);
>> image(b), axis image
```

Note that the transpose operator (the apostrophe on the end of the second line) converts a row vector into a column vector. This could also have been done with for loops, but the result is much less elegant and very much slower to execute:

```
>> for row = 1:200
    for col = 1:200
        b(row,col) = 128*(1 + cos(2*pi*row/200));
    end
end
>> image(b), axis image
```

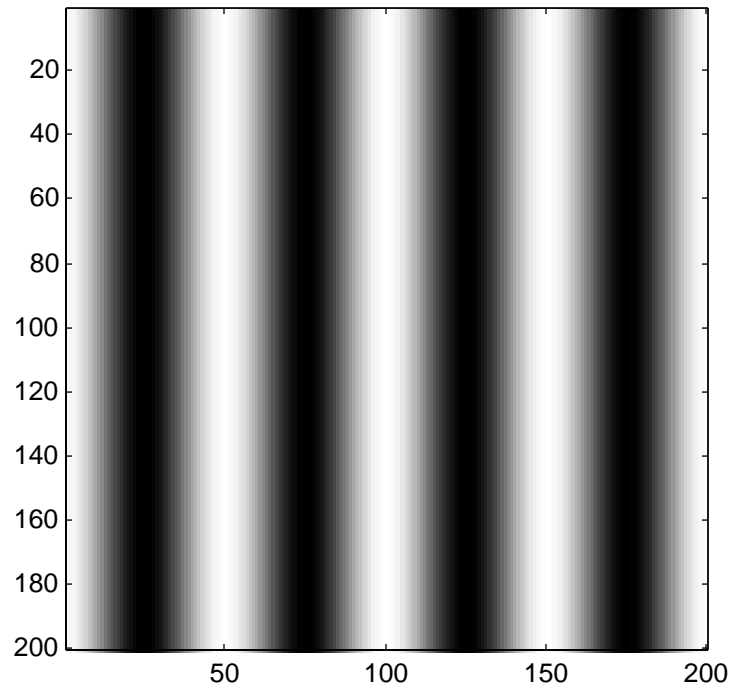
3. The following script does the job:

```
>> k = 0:199;
>> x = (sin(k*2*pi/50 + pi/2) +1);
>> c = 128 * repmat(x, 200, 1);
>> image(c), axis image
```

This differs from the previous in that there is no transpose on the second line and the frequency higher (divide by 50 rather than 200). Also, the `repmat` repeats a row rather than a column. Again, an inelegant solution using for loops is:

```
>> for row = 1:200
    for col = 1:200
        c(row,col) = 128*(1 + cos(2*pi*col/50));
    end
end
>> image(c), axis image
```

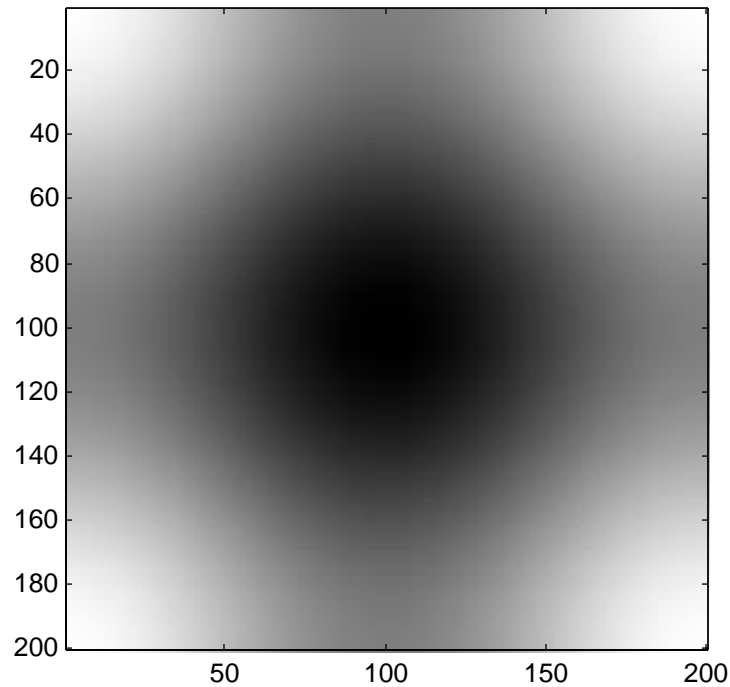
The image is shown below:



4. Using the above definitions of  $b$  and  $c$ , the following is sufficient:

```
>> d = 0.5*b + 0.5*c;  
>> image(d), axis image  
  
>> for row = 1:200  
    for col = 1:200  
        sinImage(row,col) = 64*(1 + cos(2*pi*col/200)) ...  
        + 64*(1 + cos(2*pi*row/200));  
    end  
end  
>> image(sinImage), axis image
```

The “...” indicates to Matlab that the command is continued on the next line. The result is shown below:



5. The whos command yields:

```
>> whos helen
Name          Size          Bytes   Class
helen         300x200x3         180000  uint8 array
```

This specifies that the `helen` array is  $300 \times 200 \times 3$ , from which I would infer that no colormap is used. This is a  $300 \times 200$  pixel color image with the RGB values given for each pixel. This is what is meant by 'truecolor'. Colormap images are said to be in pseudocolor. The size in bytes is 180,000, compared to a file size of 18,026. This means that the compression ratio is about 10 to 1.

6. To look at the lower right pixel:

```
>> squeeze(helen(300,200,:))

ans =

    21
    26
    56
```

In the image, we see that the upper right pixel is very light and the lower right is very dark. From this, we infer that white must be  $[255, 255, 255]$  and black must be  $[0, 0, 0]$  in truecolor images.